Headquarters U.S. Air Force

Integrity - Service - Excellence

GeoBase Efforts in Pavement Engineering

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GeoBase In Pavement Engineering Overview

U.S. AIR FORCE

- AFCESA Pavements Team Mission
- Why We Do Evaluations
- Types of Pavement Evaluations
- Who Does Them
- Use of Evaluation Data
- Pavement Evaluation Equipment
- Design, Evaluation, and Management Software
- Existing Process, Data Generated, Data Formats
- Products Delivered
- Future Plans for Change

PAVEMENTS TEAM MISSION

Provide technical support, criteria, tools, and software for the evaluation, management, design, and construction of pavements in support of the Air Force Mission around the world

GeoBase In Pavement Engineering

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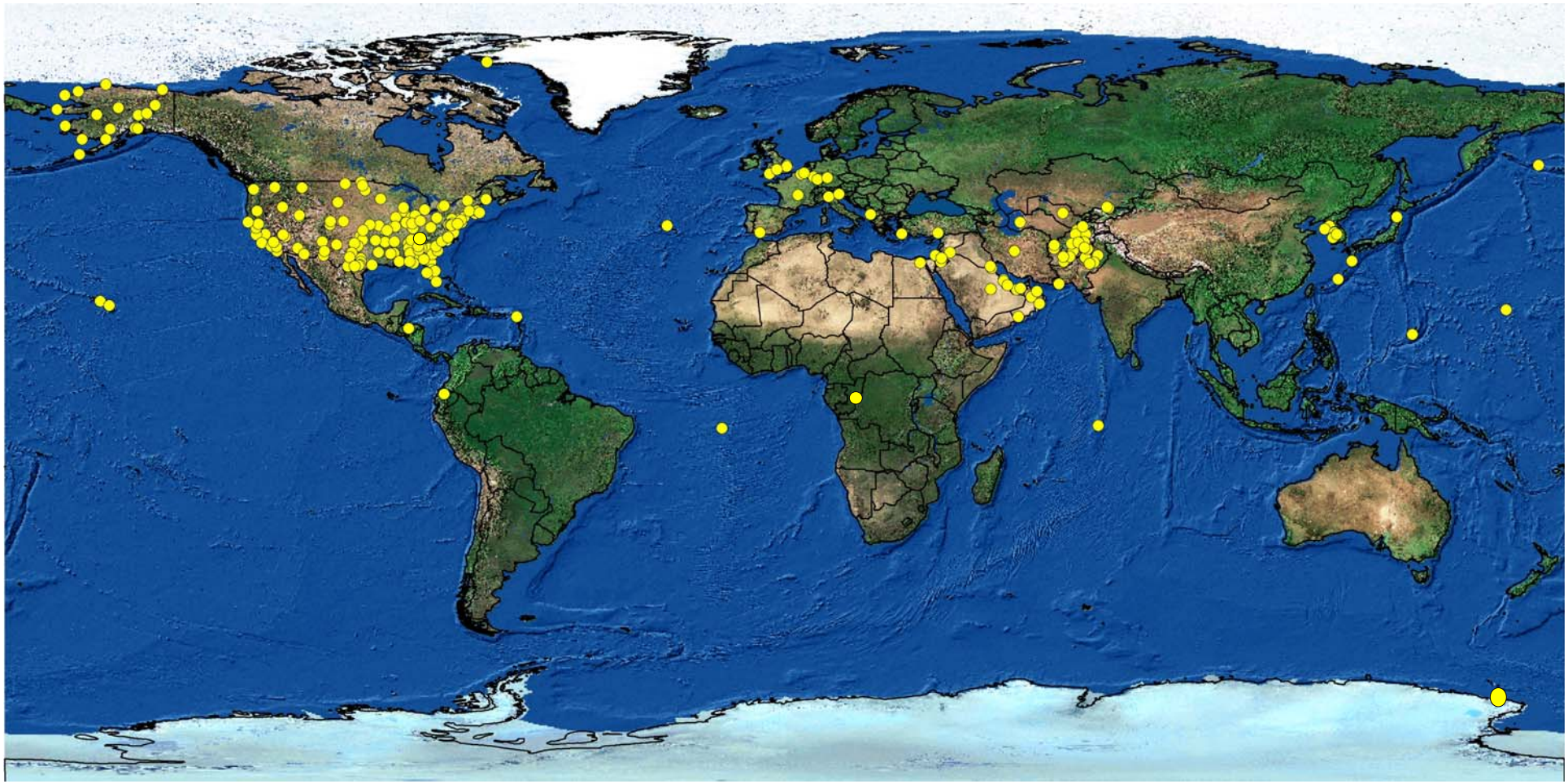

Pavement Evaluations Around the World

GeoBase In Pavement Engineering
Why We do Evaluations

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GeoBase In Pavement Engineering
Why We Do Evaluations

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GeoBase In Pavement Engineering
Why WE Do Evaluations

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GeoBase In Pavement Engineering
Why WE Do Evaluations

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Localized damage to drainage structures

GeoBase In Pavement Engineering Types of Evaluations

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- **Structural Pavement Evaluation** ***(Airfield only)***
  - **Determines structural capacity of pavements**
  - **Pavement coring & testing, soil testing, HWD testing**
  - **9 to 10 Yrs for garrison; As needed for contingency**
- **Pavement Condition Index Survey** ***(Airfield & Road)***
  - **Evaluation of the surface condition of pavements**
  - **Visual inspection using statistical sampling**
  - **3 to 5 Yrs for garrison; As needed for contingency**
- **SKID Evaluation** ***(Runways & Primary Taxiways)***
  - **Measures Surface Friction Characteristics**
  - **Use Griptester to collect data**
  - **2 to 3 Yrs for garrison; As needed for contingency**

GeoBase In Pavement Engineering
Who Does Evaluations

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In Garrison Pavement Evaluations	Expedient Structural Evaluations	Detailed Structural Evaluations	Unsurfaced Structural Evalautions	Pavement Condition Index (PCI)	Expedient PCI Surveys	Surface Friction Characteristics
HQ AFCESA Airfield Pavement Evalaution Team	X	X	X		X	X
HQ AFCESA Support Contracts				X		
628th CES (Reserves)				X		
CE Technical Services Center (ANG)				X		
HQ ACC Pavement Assessement Team (Reserves)				X		
Contingency Pavement Evalautions						
HQ AFCESA Airfield Pavement Evalaution Team	X	X	X		X	X
RED HORSE	X				X	
Contingency Response Groups (CRGs)	X				X	
AMC TALCE/AMOG Teams	X					
Special Tactics Teams			X			
Site Survey Teams	X				X	

AFCESA tasked to train teams doing contingency pavement evalautions

GeoBase In Pavement Engineering Use of Evaluation Data

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- **Determine Mission Capability**
  - Mission Changes at Home Station
  - Contingency Beddown Determination
- **Determine Safety of Operations**
  - Can I Land Aircraft X at My Base
  - Where Can I Park Aircraft X
  - What Risks are Involved
- **Airfield & Road M&R and Reconstruction**
  - Prioritize Maintenance and Repair
  - Prioritize Funding
- **Who Uses this Data**
  - CFACC and CFLCC, Warplanners, BRAC, NGA, MAJCOM Engineers, Safety Boards, Wing Commanders, Base Civil Engineers, Base Airfield Managers…and Many Others

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GeoBase In Pavement Engineering
APE Team Equipment

ADCP *(Structural)*

CORE DRILL *(Structural)*

ECP *(Structural)*

HWD / VAN *(Structural)*

GRIPTESTER *(SKID)*

2

GeoBase In Pavement Engineering Contingency Evaluation Equipment

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ADCP *(Structural)*

ECP *(Structural)*

DCP *(Structural)*

Visual *(PCI)*

Hilti Drill *(Structural)*

GeoBase In Pavement Engineering Design, Evaluation, Mgmt Software

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Design and Evaluation Software

Empirical and layered-elastic modules used to design and evaluate flexible and rigid pavements for airfields, roads, and parking lots

AF Users

- AFCESA APE Team
- RED HORSE, AMOGs, TALCEs, CRGs
- MAJCOM Pavement Engineers
- Base Pavement Engineers
- Airfield Managers

United States Army Corps of Engineers
Micro PAVER

Pavement Management Software

Data entry and analysis modules used to determine the PCI and maintenance policies for flexible and rigid pavements on airfields, roads, and parking lots

AF Users

- AFCESA APE Team
- MAJCOM Pavement Engineers
- Base Pavement Engineers
- Airfield Managers

Tri-service programs to provide software tools to implement criteria and enhance the ability of engineers to design, evaluate, and manage airfield, road, and parking lot pavements in both the garrison and contingency environments

GeoBase In Pavement Engineering
PAVER/PCASE Desktop

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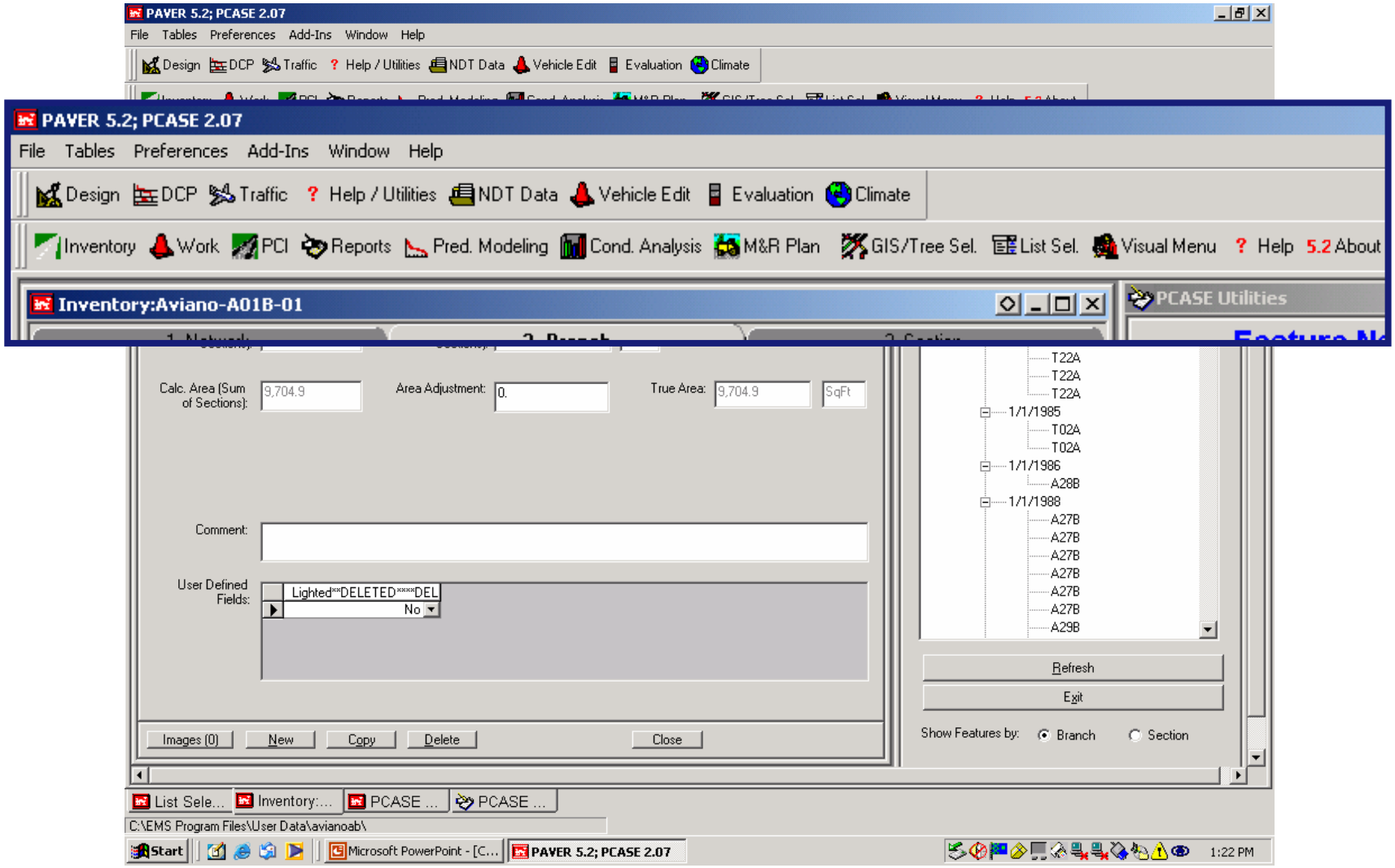

GeoBase In Pavement Engineering Existing Process

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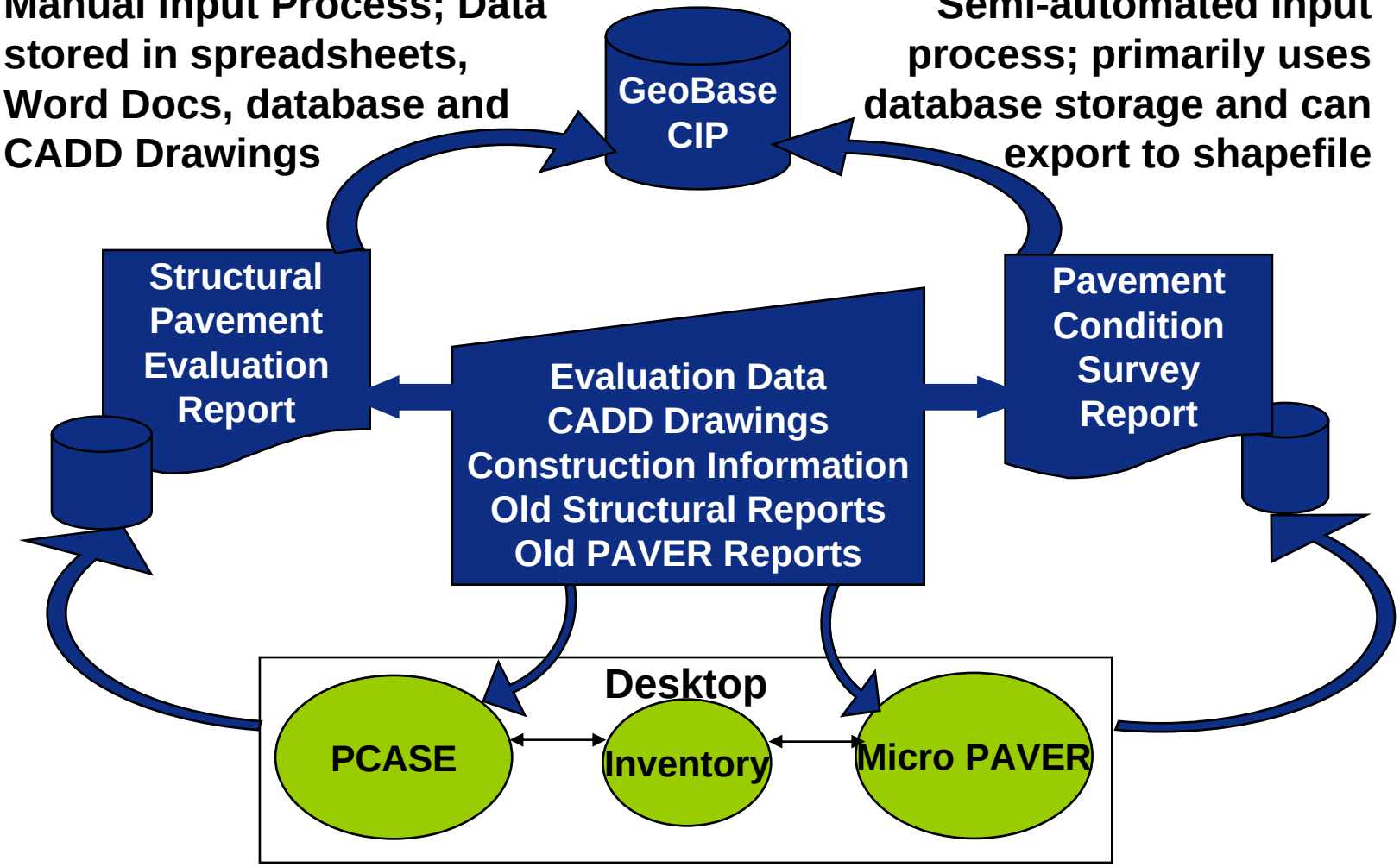
Manual Input Process; Data stored in spreadsheets, Word Docs, database and CADD Drawings

Semi-automated Input process; primarily uses database storage and can export to shapefile



GeoBase In Pavement Engineering *Structural* Products Delivered

- **Structural evaluation drawings developed in AutoCad and delivered in PDF format as part of the report**

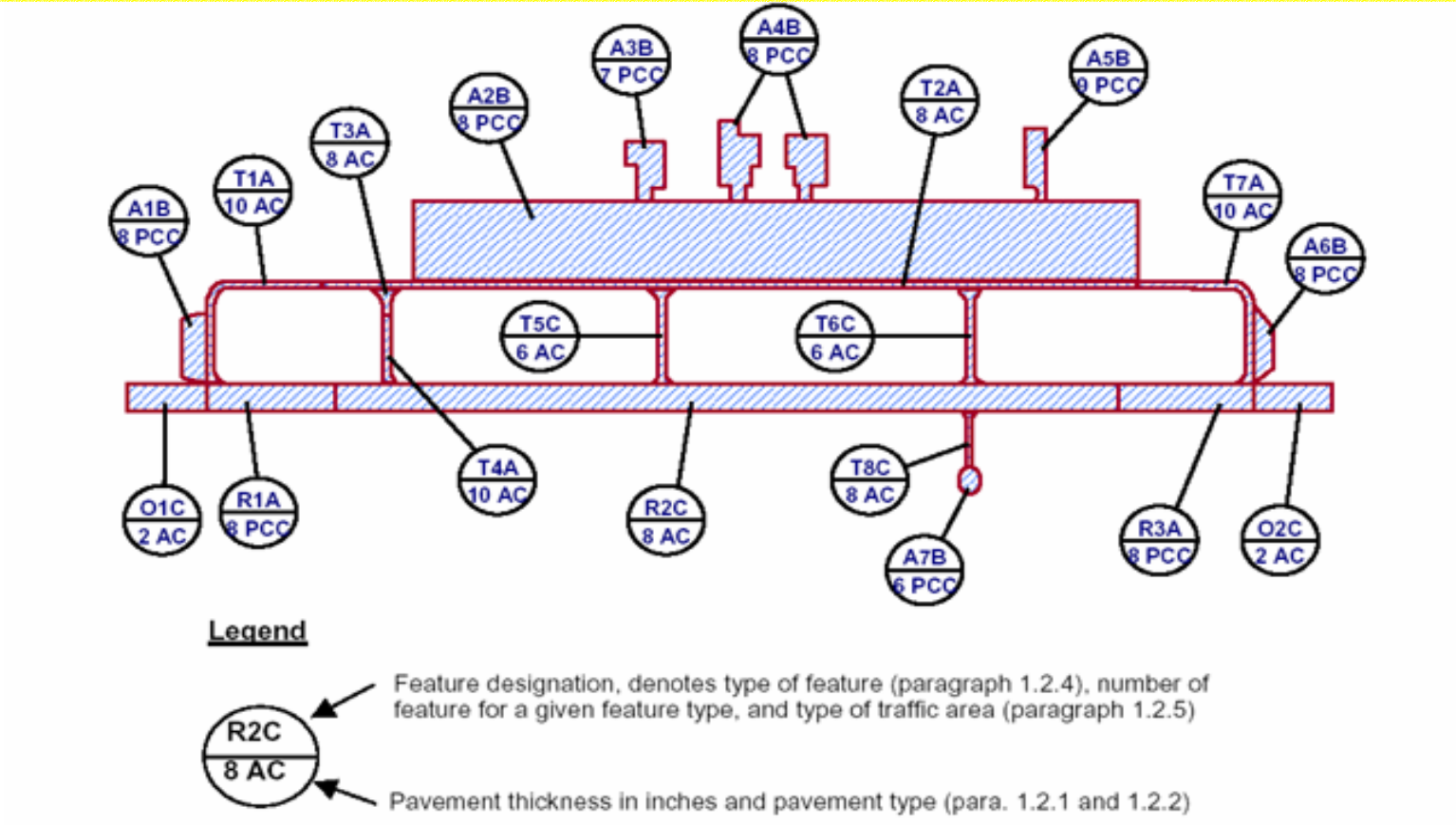


Figure 2. Airfield Layout/Feature Plan

GeoBase In Pavement Engineering
Structural *Products Delivered*

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PHYSICAL PROPERTY DATA
Westover ARB, Massachusetts

				OVERLAY PAVEMENT			PAVEMENT			BASE			SUBBASE			SUB-GRADE	
FEAT	IDENT	AREA sq ft	COND	THICK (in)	DESC	FLEX (psi)	THICK (in)	DESCRP	FLEX (psi)	THICK (in)	DESCRP	K/CBR	THICK (in)	DESCRP	K/CBR	DESC	K/CBR
A01B	WARM-UP APRON RUNWAY 05	270,000	VERY GOOD	-	-	-	15.25	PCC	800	9.00	SAND (SP)* (NFS)	525	28.00	SILTY SAND (SM)* (S-2)	-	SAND (SP)* (NFS)	-
A02B	HANGER APRON	375,000									SAND			3" AC*		SILTY SAND	
A03B	EAST RAMP	1,155,000															
A04B	EAST RAMP	920,000															

CONSTRUCTION HISTORY
Westover ARB, Massachusetts

FEATURE	DESIGNATION	APPROX CONST PERIOD	TYPE & THICKNESS (IN)	REMARKS
A01B	WARM-UP APRON RUNWAY 05	1956	15.00 PCC	ORIGINAL CONSTRUCTION
A02B	HANGER APRON	1955	15.00 PCC	ORIGINAL CONSTRUCTION
A03B	EAST RAM	1955	14.00 PCC	ORIGINAL CONSTRUCTION
A04B	EAST RAM			

PAVEMENT CLASSIFICATION NUMBERS*
WESTOVER ARB, MASSACHUSETTS
Non-Frost Period

FEATURE	PCN	FEATURE	PCN	FEATURE	PCN	FEATURE	PCN
A01B	61/R/B/W/T	R11A	55/F/B/W/T	A18B	36/R/C/W/T	T20A	29/F/A/W/T
A02B	42/R/C/W/T	R12A	44/F/A/W/T	A19B	90/F/A/W/T	T21A	40/R/C/W/T
A03B	37/R/D/W/T	T01A	37/F/A/W/T	A20B	47/R/C/W/T	T22A	44/R/C/W/T
A04B	58/R/C/W/T	T02A	41/F/A/W/T	O01C	38/F/A/W/T	T23A	54/R/D/W/T

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GeoBase In Pavement Engineering
Structural *Products Delivered*

Feature Name	Pass Intensity Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
R01A	I	+	26	A	94	52	A	A	149	A	A	385	293	A	A
	II	+	30	A	102	57	A	A	163	153	350	419	335	A	A
	III	+	33	A	117	65	67	A	186	174	454	474	398	484	A
	IV	+	38	A	140	78	80	A	221	207	528	557	479	583	A

+ : AGL above maximum aircraft weight

A : AGL below minimum aircraft weigh

AGLs are reported within a range:

Min Weight of Lightest Aircraft -- Max Weight of Heaviest Aircraft

RELATED DATA

AIRCRAFT GROUP INDEX

	LIGHT LOAD			MEDIUM LOAD								HEAVY LOAD		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	A-37 C-12 C-21 *C-23 T-37 T-1A	A-7 A-10 F-4 F-5 *F-15 F-16 F-10X T-33 T-38 T-39 OV-10 C-20	*F-111 FB-111	*C-130	C-7 *C-9 DC-9 C-140	B-737 *T-43	*B-727 C-22	B-707 *E-3 C-135 *KC-135 VC-137 DC-8 EC-18 A-300 B-767	*C-141 B-1 B-757	*C-17	*C-5	*KC-10 DC-10 L-1011	B-747 *E-4 VC-25	*B-52

* CONTROLLING AIRCRAFT

GROSS WEIGHT LIMITS FOR AIRCRAFT GROUPS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	PAVEMENT CAPACITY IN KIPS													
LOWEST POSSIBLE GROSS WEIGHT	5	7	53	69	19	60	96	135	144	279	375	270	414	230
HIGHEST POSSIBLE GROSS WEIGHT	26	81	100	175	122	150	210	380	477	585	837	590	870	480

PASS INTENSITY LEVELS

LEVEL	1	2	3	4	5	6	7	8	9	10	11	12	13	14
I	300,000 PASSES			50,000 PASSES								15,000 PASSES		
II	50,000 PASSES			15,000 PASSES								3,000 PASSES		
III	15,000 PASSES			3,000 PASSES								500 PASSES		
IV	3,000 PASSES			500 PASSES								100 PASSES		

GeoBase In Pavement Engineering
PCI Survey Products Delivered

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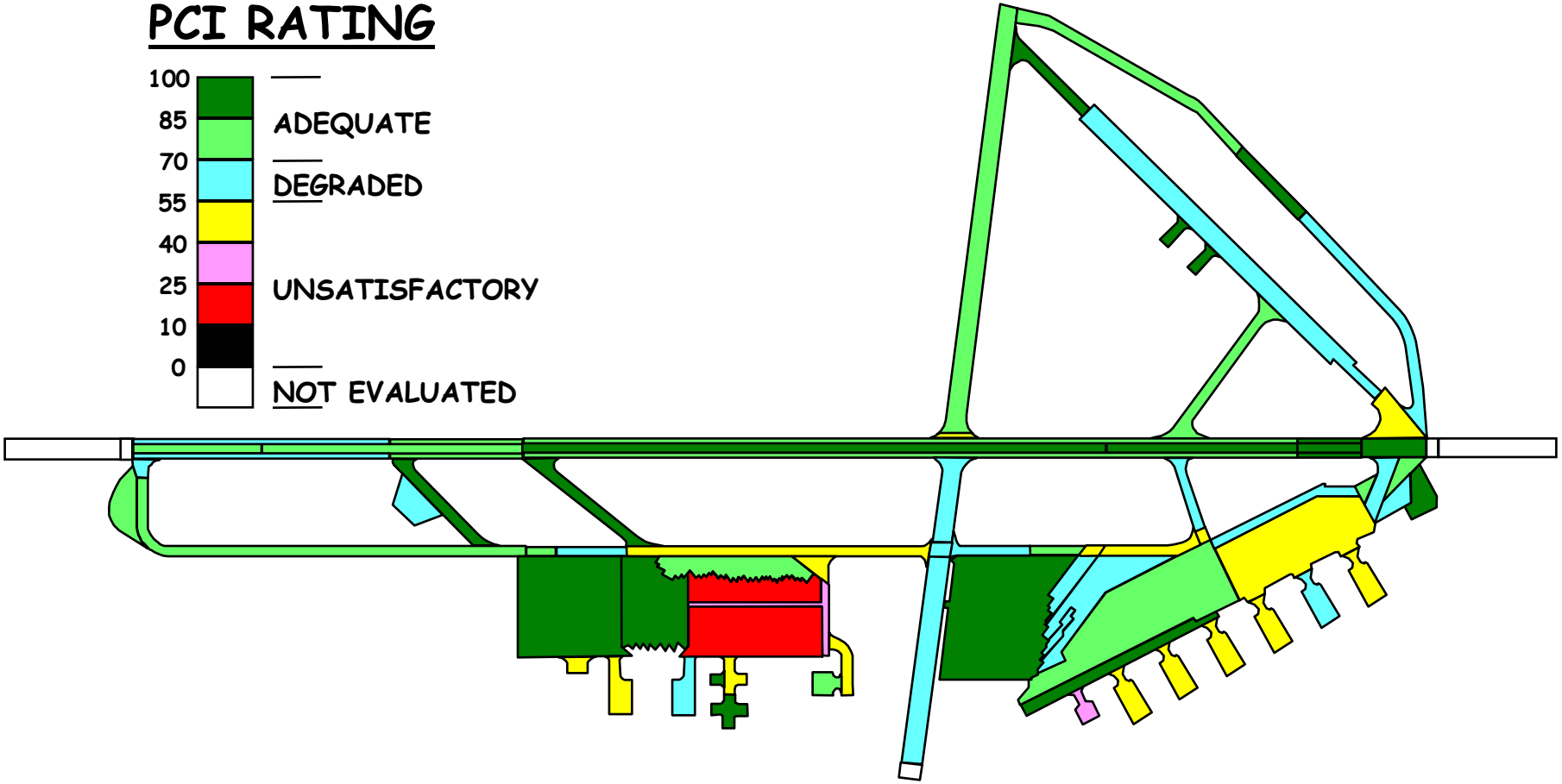
- **Pavement Condition Index Survey drawings developed in AutoCad and delivered in PDF format as part of the report as well as .SHP Files**



GeoBase In Pavement Engineering
PCI Survey Products Delivered

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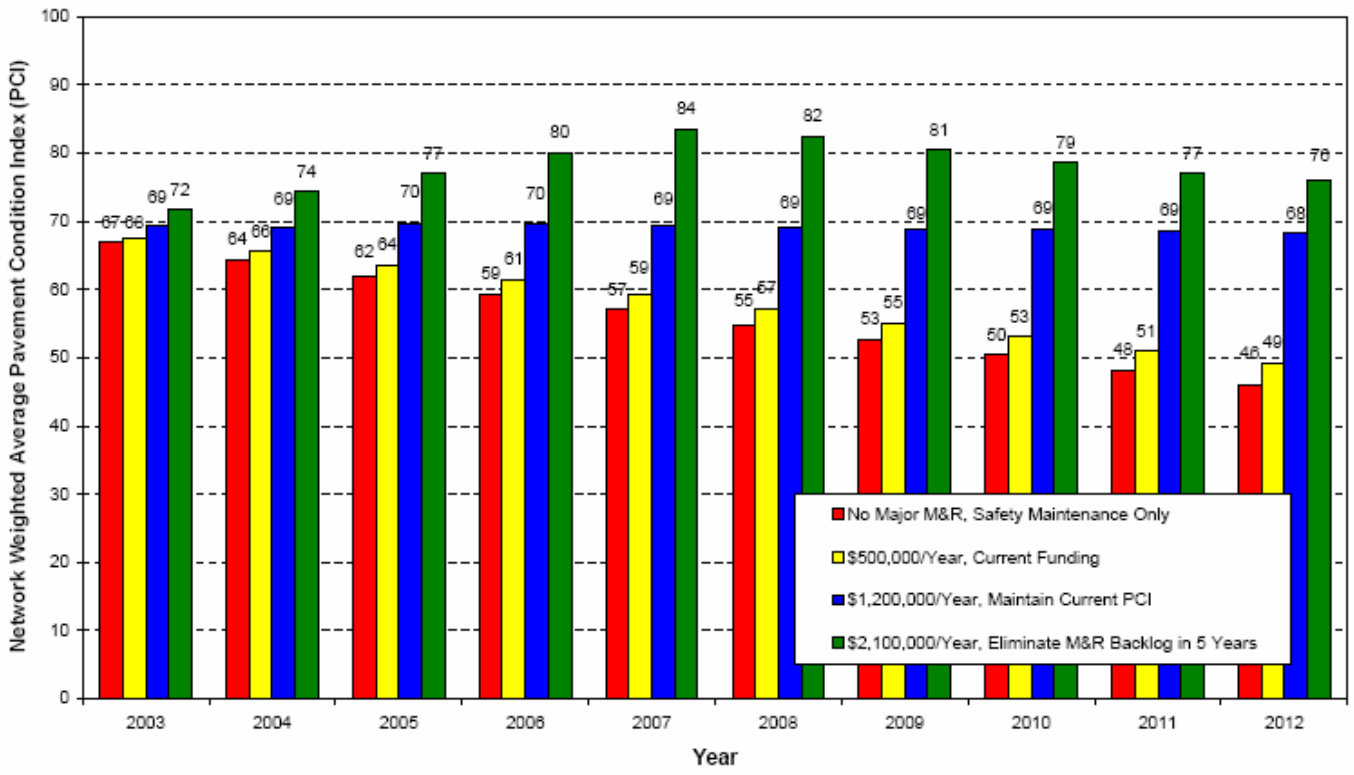
Surface Type	Number of Pvt. Sections	Percent of Total Pvt. Sections	Pvt. Area, SF	Percent Total Pvt. Area	Weighted Average Age	Weighted Average Condition
Asphalt Concrete, AC	**413** 433	**89%** 87%	**8,463,723.08** 8,826,063.08	**84.00%** 83.00%	**12.80** 12.42	**67.60**
Asphalt on Asphalt, AAC	**23** 29	**5%** 6%	**1,176,239.00** 1,265,439.00	**12.00%** 12.00%	**11.76** 10.93	**79.73**
Portland Cement Concrete, PCC						
All Inspected All Inventoried						



GeoBase In Pavement Engineering
SKID Products Delivered

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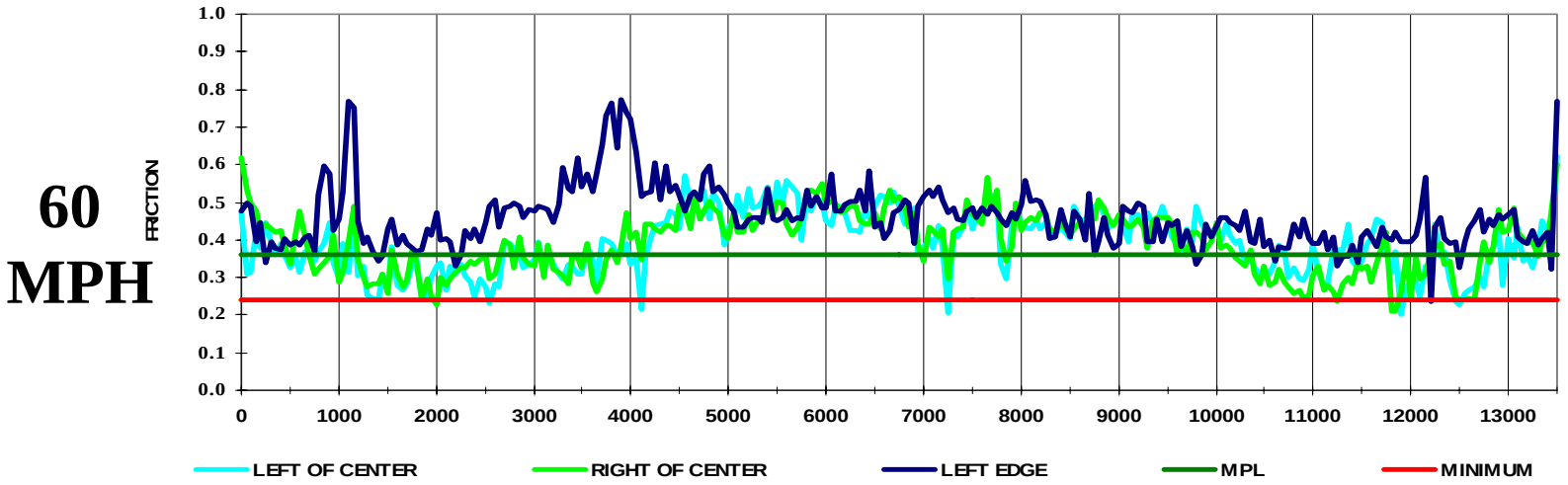
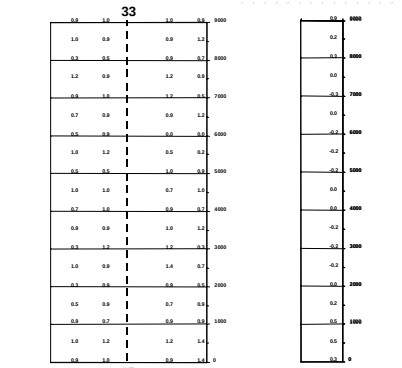


SLOPE MEASUREMENTS

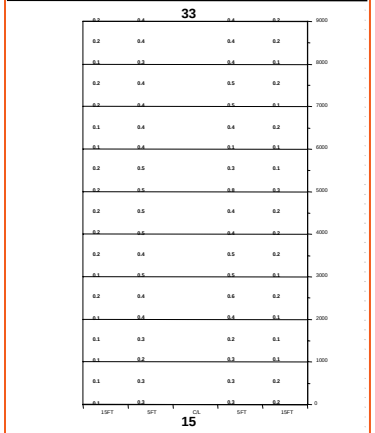


1. ALL TRANSVERSE SLOPE MEASUREMENTS WERE TAKEN WITHIN 20' (6.1M) OF THE CENTERLINE.
2. POSITIVE SLOPE VALUES INDICATE DRAINAGE AWAY FROM CENTERLINE.
3. NEGATIVE SLOPE VALUES INDICATE DRAINAGE TOWARD CENTERLINE.

1. ALL LONGITUDINAL SLOPE MEASUREMENTS WERE TAKEN AT CENTERLINE.
2. POSITIVE SLOPE VALUES INDICATE DRAINAGE TOWARD SECONDARY END OF RUNWAY 33 .
3. NEGATIVE SLOPE VALUES INDICATE DRAINAGE TOWARD PRIMARY END OF RUNWAY 15 .

RAINFALL (INCHES/HOUR)

TO FLOOD THE AVERAGE PAVEMENT TEXTURE DEPTH



SURFACE TEXTURE MEASUREMENTS

LOCATION		PAVEMENT TYPE	SURFACE RUBBER	LENGTH OF 4" WIDE TEST STRIP		AVERAGE TEXTURE DEPTH (ATD)	
FT FROM PRIMARY END	FT FROM CENTER LINE			INCHES	MM	INCHES	MM
1300	5R	NEW PCC	LIGHT	17.50	444.5	0.0131	0.3321
1300	20R	NEW PCC	NONE	16.50	419.1	0.0139	0.3523
2400	5L	PCC	LIGHT TO MEDIUM	14.50	368.3	0.0158	0.4008
2400	20L	PCC	NONE	10.00	254.0	0.0229	0.5812
5400	5R	NEW PCC	NONE	9.00	228.6	0.0254	0.6458
5400	20R	NEW PCC	NONE	8.00	203.2	0.0286	0.7265
7500	5L	PCC	MEDIUM	14.00	355.6	0.0163	0.4152
7500	20L	PCC	NONE	11.50	292.1	0.0199	0.5054

GeoBase In Pavement Engineering
Pavement Data Gathered

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- Feature Designation
- Construction History
- Pavement Use
- Pavement Type
- Vehicle/Aircraft Traffic
- Test Locations
- Surface Distresses
- Pavement Thickness
- Concrete Flex Strength
- Pavement Modulus
- Soil Layer Thickness
- Soil Types
- Soil Moisture Content
- Soil Strength (CBR & K)
- Pavement Deflection Data
- Layered Elastic Model Data
- Allowable Gross Loads
- PCNs
- Sample Unit Distress Data
- Pavement Condition Index
- FOD Index
- Structural Index
- Engineering Assessment
- Repair Cost Data
- Family Deterioration Model
- Slope Measurements
- Texture Measurements
- Friction Coefficient
- Photos
- Metadata

GeoBase In Pavement Engineering Integration Goals

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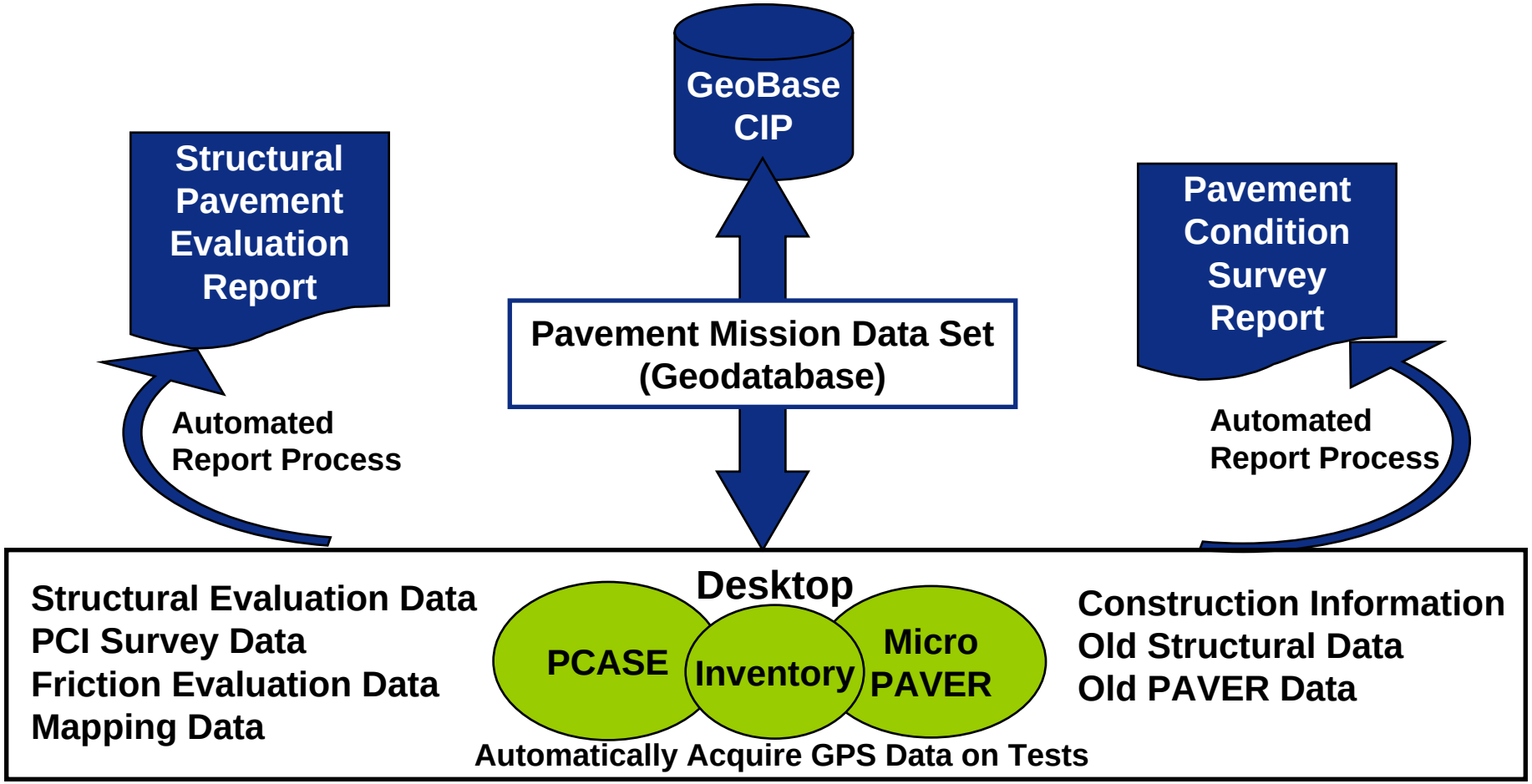

GeoBase In Pavement Engineering
GeoBase Integration Vision

- **Integrate PAVER and PCASE**
  - **one database for all pavements data (structural, PCI, or SKID) for each base**
- **Geo-enable Integrated PAVER-PCASE**
  - **Use the CIP as the mapping component and push the modified map and data back to the CIP**
  - **Edit the map and create map data associations quickly within the PAVER-PCASE application**
  - **Automated Report Generations Tools**
- **Create a Geo-enabled evaluation module for Contingency Pavement Evaluation Teams**

GeoBase In Pavement Engineering Future Plan

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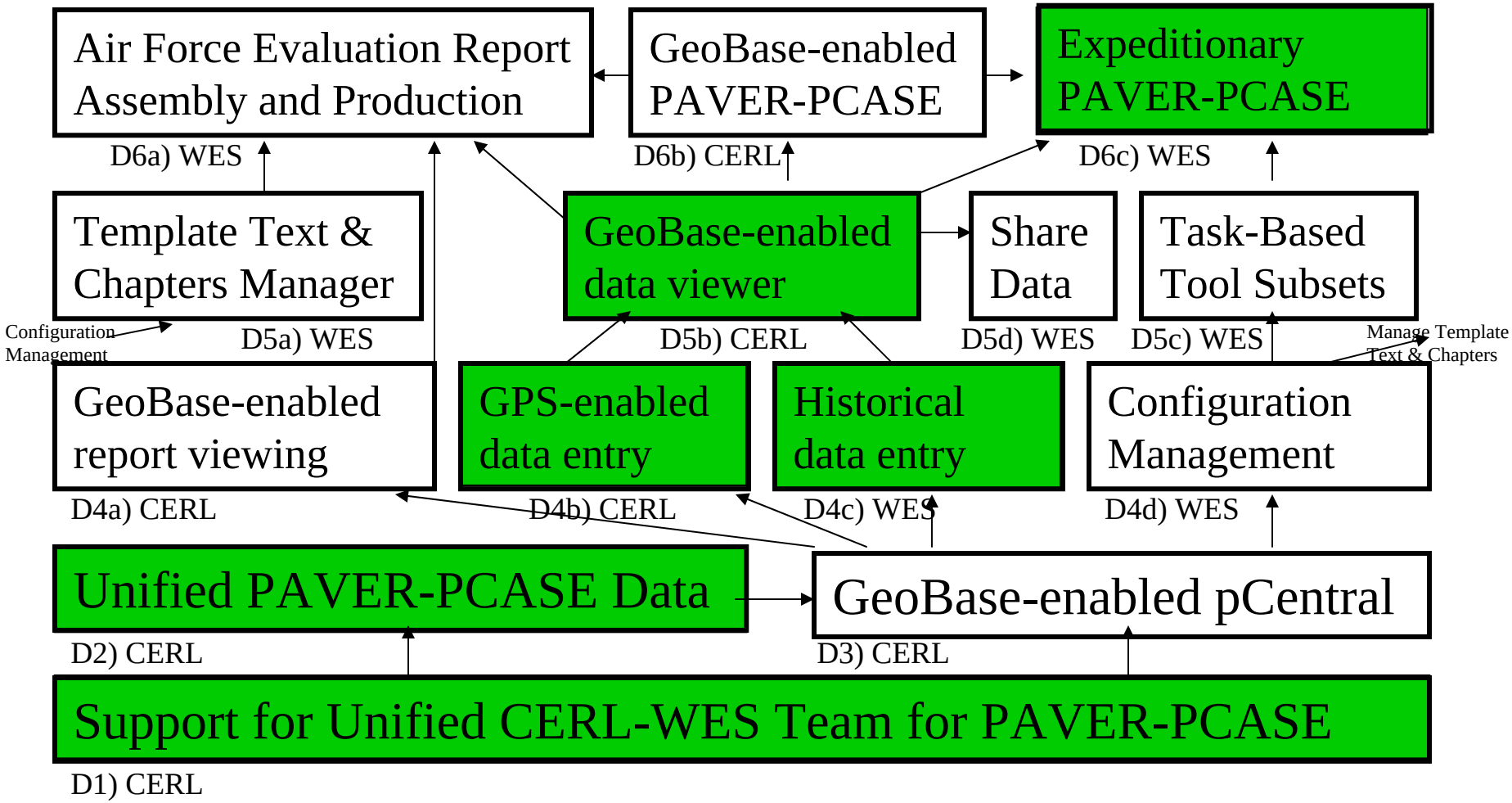

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GeoBase In Pavement Engineering Current Efforts

- **Integrating GPS Equipment in Pavement Evaluations**
- **Modified PCASE to push AGL, Allowable Passes, PCN, and ACN/PCN ratio data to PAVER inventory tables**
- **Modified PCASE database to accept GPS data**
- **Modifying PAVER to accept GPS data creating ability to broadcast GPS section selected**
- **Expanding PCASE to accept PPD and Model Data**
- **Creating Module to set PAVER Default Parameter**
- **Developing Contingency Evaluation Module**
- **Developing Minimum Operating Strip computation tool (from Repair Quality Criteria T.O.)**

Expect to have above completed in beta releases of PAVER and PCASE in Spring 05
Completion of entire effort dependent of funding—goal FY 06

GeoBase In Pavement Engineering Summary

U.S. AIR FORCE

- **Pavement Evaluations are Good Source of data**
- **Currently much of the data from Evaluation reports must be manually input into the CIP**
- **Working on Integrating PAVER and PCASE to create one pavement database for a given base**
- **Goal is to ultimately Geo-enable PAVER-PCASE with a single pavements geodatabase as output**

Headquarters U.S. Air Force

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QUESTIONS?

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U.S. AIR FORCE

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17 Aug 04